

River Adventure on the Delaware



Overview

Congratulations! You have signed up for the River Adventure on the Delaware program, a unique program that allows students to get their hands on learning about the Delaware Estuary. The program consists of two components: one onboard a sailboat, the other inside Independence Seaport Museum. Attached is material you can use to prepare your students for their experience including lesson plans that can be used in the classroom. Each section is divided into the three programs that students will participate in at the Independence Seaport Museum: walking tour, gallery program, and OLYMPIA program. A separate pre-visit packet is available for the schooner portion of the program.

Academic Standards

Academic Standards for Environment and Ecology: 4.1.7.B, E,
4.1.10. B, E, 4.2.7. A, B, C, D 4.2.10. A, B, C, D 4.3.7.B 4.3.10.B 4.7.7.C.
4.8.7.A, B, C, D 4.8.10.A, B, C, D

Academic Standards for Science and Technology: 3.5.7.B, D 3.5.10 B, D
3.8.7. A, B, C 3.8.10 A, B, C

Academic Standards for Geography: 7.3.6 C, D 7.3.9 C, D 7.4.6 A, B
7.4.9 A, B

Teacher Background

Everyone lives in a watershed, an area of land through which water flows to a common outlet. The majority live downstream by studying one, a sense of the impact of human interaction on natural resources can be fostered. By investigating a small watershed, like the Dock Creek watershed at Penn's Landing, plus the uses that have been made of it and the pollution that has gone into it, students will be able to better understand how much the Delaware River Watershed and has been altered by human interaction.

Did you know?

The Delaware River ...

- is the longest undammed river east of the Mississippi.
- is 330 miles long.
- has 216 tributaries, the largest are the Schuylkill and Leigh rivers.
- has a watershed 13,539 miles square miles draining the state of Delaware (7.9%), New Jersey (23.3%); Pennsylvania (50.3%); New York (18.5%).

The Walking Tour

At Independence Seaport Museum, students will take an hour walking tour from the banks of the Delaware River to Independence Hall to see how the Dock Creek Watershed has changed since Benjamin Franklin arrived.

Teacher Background: DOCK CREEK WATERSHED

The Dock Creek watershed is a good place to learn about wetland, watersheds and how people interact with them. The Philadelphia Riverfront in this area was high and dry when William Penn arrived in 1692. The area offered opportunities for fishing, transportation and trade. The choice of the site for Philadelphia was probably due to the favorable impression this stream made on the original planners. It was named Dock Creek because settlers thought it would become a permanent dock. Along the Creek, some of Philadelphia's most prosperous early citizens made their homes. The soil was grassy, the water clean, and the summer view pleasant. The colonists who came over in those first years wasted no time in clearing the woodlands and filling in the wetlands for fuel and to make way for homes. There were approximately 7,000 acres of shallow water habitats within the future city limits when Penn arrived. By the end of the colonial period there were 500. Trade and industry took advantage of the waterway. Anthony Morris set up a brewery on its banks and tanneries and lumberyards were constructed. Everyone used the Creek as a dumping ground. By 1799, the Dock Creek had been turned into a sewer and the riverfront was a mess.

The City's first pollution survey taken that year, found pollution from ships, sewers and contaminated wetlands was threatening the health of the city and the river. After the American Revolution, the creek was covered. It had become stagnant, ill smelling and there was no doubt that it often contributed to disease. Thieves and robbers hid along its banks and on occasion tipsy men sometimes fell into the foul water. The creek was covered and a street was created to replace it.

DOCKCREEK WATERSHED (CONT.)

In just over a century's time, the pre colonial Riverfront changed from a predominantly wild, wooded area. This healthy river, teeming with life, became a farming and recreational area whose river supported the needs of the new colony throughout the 1700's, and then to a dangerously polluted hub of industry beginning in the 1800's. By the early 1900's the River was so polluted it could not support aquatic life. The River was receiving raw sewage from two million people. By 1941, there was a 20-mile pollution block, a dead zone, in the Camden-Philadelphia region, a zone containing no dissolved oxygen. The water was no longer safe to swim in, drink or even breathe because of the odors of the sewage.

But the River has been making a come back. Since the end of World War II, more than one and a half billion dollars have been spent building and improving sewage treatment plants. By 1986, dissolved oxygen was up and 36 species of fish lived in what was once the Dead Zone. Today, the Delaware watershed is the most intensely used area in the country. The watershed provides water for 7.4 million people living within its borders and for an additional 17 million people outside it, in New York and northern New Jersey. The Watershed provides water for 5% of the Nation's population.

Walking Tour Pre-visit Questions and Activities

Use these questions to prepare your students for the walking tour of Dock Creek Watershed.

1. What four states make up the Delaware River Watershed?
2. Name two of the major cities on the River.
3. You have just gotten a job as an eco-tour operator. Your assignment is to make a travel brochure that will attract people to the beauties of the Delaware. Use an 8x10 piece of paper. Fold it at least once. Make sure it has an attractive cover and tells the potential tourist how to get to Philadelphia.



Gallery Program—Point and Nonpoint Source Pollution

Students in the galleries will test three different types of water to determine if they can see if water is polluted. Then, they will divide into small teams to evaluate development projects for the Philadelphia waterfront by identifying which is a point and non-point polluter.



Teacher Background: Point and NonPoint Source Pollution

Nonpoint Source Pollution (NPS) is defined as pollution in a watershed whose entry is difficult to locate; you can't point to its source. **Point Pollution**, on the other hand, comes from specific sources such as sewage treatment plants and industrial facilities and can often be located. While control of **Point Source Pollution** is improving, **Nonpoint Source Pollution** is growing. NPS pollution occurs when rainfall, snowmelt or irrigation runs over or through the ground picking up **pollutants** and deposits them in bodies of water or in the ground water. NPS pollution is the nation's largest source of water quality problems and usually occurs when activities disturb the land or water.

One of the big problems with urban areas is **non-porous surfaces**. Streams in a town or suburb are usually very different from streams in a forest or other natural areas. Urban streams tend to carry more water at a faster speed after a storm than their country cousins. When rain hits the earth's surface in natural areas, about half the water that falls to earth soaks or infiltrates the soil. Most of what remains on the ground returns to the atmosphere by evapotranspiration, a combination of evaporation and transpiration (loss of water vapor by plants). In urbanized areas, covered by impervious surfaces (roads, parking lots, driveways, rooftops) only a small portion of rainfall (10%) is absorbed and the rest travels across the land as runoff into our waterways.

When rain has no chance to infiltrate the soil, the water has no choice but to flow down hill into street drains and then into streams. What runs off into the waterways are accumulated pollutants.

The major pollutants that runoff are:

Pathogens: Disease-causing microorganisms (bacteria and viruses) found in human and animal waste.

Pathogens run off the land from farms, pets, septic tanks, leaky sewers and boat bathrooms.

NONPOINT SOURCE POLLUTION (CONT.)

Nutrients: These are compounds that encourage plant growth (nitrogen and phosphorus). In high concentrations they become harmful to the environment.

Large amounts of nitrogen in drinking water causes “baby blue” syndrome.

High amounts of nitrogen causes too much algae to grow, cutting off oxygen to water life. Nutrients come from fertilizers, septic systems, home lawn care products and pet wastes.



Sediment: This is sand, dirt and gravel that runs off into waterways. Although these are naturally found in ponds, streams and lakes, too much sediment can disrupt aquatic life and change the way water flows. Too much sediment is usually caused by construction sites, roadways and suburban gardens.

Toxins: Toxins are heavy metals, pesticides and organic compounds such as PCB's (polychlorinated biphenyls). Toxins run off into waterways usually due to human practices such as dumping oil, grease, gasoline into sewers as well as using lawn chemicals that wash into drains.

Debris: Trash is the most easily identifiable pollutant and caused by direct dumping into waterways or by runoff. Run off usually happens when street litter is brought down drains by rain.

Urbanization is on the increase. Population trends indicate that by 2010 more than half the nation will live in coastal towns and cities. This trend means an increase in the amount and variety of pollutants transported to receiving waters. These would include sediments from developments and new construction, oil, grease and toxic chemicals from cars, nutrients and pesticides from turf management and gardens, virus and bacteria from failing septic tanks, road salts and heavy metals. The work of controlling NPS pollution is on going and must include everyone in the watershed.

Gallery Program Pre-visit Activity—NonPoint Source Pollution Game

Students should have a basic understanding of the differences between point and nonpoint source pollution before arriving to Independence Seaport Museum.

Objectives:

By playing a game, students will be able to define the differences between point and nonpoint source pollution and identify some of their sources.

Materials:

- Pollution game playing cards (Copy sets for each team and cut out cards)
- Die (from another game)
- Game pieces (Copy and cut out one set per team)
- Game board
- Chalkboard or large piece of paper
- Markers or chalk
- Prizes for winners

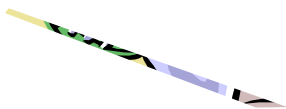
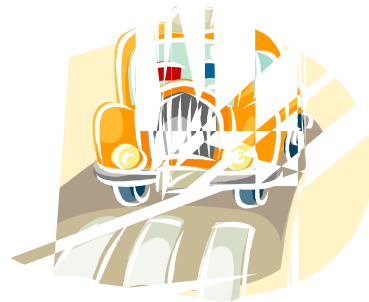
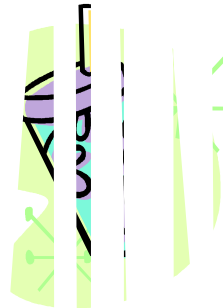
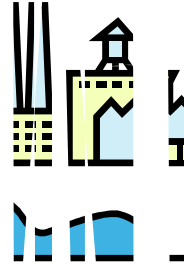
Procedure:

1. Use the images from the teacher packet to explain the differences between point and nonpoint source pollution. Define
2. Divide the class into groups of five. Ask students to pick a game piece.
3. Game Rules—
Each player starts at the starting line and each player rolls the dice to see who goes first (the highest roll). First player rolls dice and moves number of spaces on the die. Then they follow the directions on the space. Winner gets to the finish line first.





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<p>Point Pollution Card</p> <p>Draw a picture of :</p> <p>A construction site dumps extra dirt into the river.</p>	<p>Point Pollution Card</p> <p>Draw a picture of :</p> <p>A leather factory dumps dyes into river.</p>
<p>Point Pollution Card</p> <p>Draw a picture of :</p> <p>An oil refinery dumps oil into the river.</p>	<p>Point Pollution Card</p> <p>Draw a picture of :</p> <p>A nuclear power plant, when creating electricity, dumps hot water into the river.</p>
<p>Point Pollution Card</p> <p>Draw a picture of :</p> <p>A paper mill dumps chemicals into the river.</p>	<p>Point Pollution Card</p> <p>Draw a picture of :</p> <p>Staff from an outdoor music arena dumps trash from concerts into the river.</p>

NonPoint Pollution Card

Draw a picture of :

A child throws a soda can into the river.

NonPoint Pollution Card

Draw a picture of :

A man fertilizers his lawn. The rain washes the fertilizers down the sewer.

NonPoint Pollution Card

Draw a picture of :

Cars drop oil in a Walmart parking lot that is next to a river. The rain washes the oil into the river.

NonPoint Pollution Card

Draw a picture of :

A car in a driveway drops oil. The rain washes the oil down the sewer.

NonPoint Pollution Card

Draw a picture of :

A farmer uses fertilizers to make his plants grow. The fertilizers are washed into the river by rain.

NonPoint Pollution Card

Draw a picture of :

A herd of cows cross a stream and leave animal waste as they cross.

NonPoint Pollution Card

Draw a picture of :

Workers from a construction site across the river dumps trash into the river.

NonPoint Pollution Card

Draw a picture of :

Trash from an apartment building blows into the river.

NonPoint Pollution Card

Draw a picture of :

A motorboat leaks oil from its engine as it cruises the river.

NonPoint Pollution Card

Draw a picture of :

Animal waste from a dog park washes into a river.

All Play Card

Draw a picture of:

A video game production plant
dumps plastic wrappers into the river.

Is it point or nonpoint pollution?

All Play Card

Draw a picture of:

A prison along the river dumps
unused license plates into the river.

Is it point or nonpoint pollution?

All Play Card

Draw a picture of:

A company that loads fruit from ships
to trucks leaves old bananas on the
dock.

Is it point or nonpoint pollution?

All Play Card

Draw a picture of:

A family cookout at a park along the
river leaves trash behind.

Is it point or nonpoint pollution?

All Play Card

Draw a picture of:

A jetskiier dumps his excess soda
into the river while riding.

Is it point or nonpoint pollution?

All Play Card

Draw a picture of:

A woman changes the oil in her car
and dumps the old oil down the
sewer.

Is it point or nonpoint pollution?

All Play Card

Draw a picture of:

Workers at a construction site dump
extra dirt into the river.

Is it point or nonpoint pollution?

All Play Card

Draw a picture of:

A ship bringing oil to an oil refinery
leaks oil into the river.

Is it point or nonpoint pollution?

All Play Card

Draw a picture of:

A video game production plant
dumps plastic wrappers into the river.

Is it point or nonpoint pollution?

All Play Card

Draw a picture of:

After painting a nursery a woman
dumps paint thinner down the kitchen
drain.

Is it point or nonpoint pollution?

OLYMPIA Program

Onboard Cruiser OLYMPIA, students will take on the role of an environmental engineer and evaluate the historic ship in terms of its renewable and nonrenewable resources.



Teacher Background: RENEWABLE AND NONRENEWABLE RESOURCES

The next pollution problem strikes closer to home. It deals with how we live our lives and the choices we make about the future of our city. **Renewable and nonrenewable resources** are used to make the things we use everyday. Renewable resources, if not abused, are replenished over time by natural processes. They include the essentials of human survival, water, oxygen, food and shelter. Non-renewable resources such as iron, coal, petroleum, once used, are gone. There is a limited amount and while there maybe enough for the foreseeable future, the resource will run out eventually. The process of making these resources usable has an enormous impact on the environment. Take cars for instance. Imagine the environmental cost of getting the materials, transportation them to the factory, manufacturing the car, getting gas and oil to run the car and then what do you do with the car once its useful life is over.

Sustainable Development is one of the most important movements for the future. It is defined, as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It raises questions about where we live, what we wear, how we get around and what we will be doing for a living. It asks us to think about the future.



OLYMPIA Program—Other Activities

Materials: Pictures of resources from magazines and newspapers, samples of resources (if available)

Set: Today we will learn that some resources can be easily replaced and some cannot be easily replaced.

Instruction:

1. Introduce terms renewable and nonrenewable. Write the terms and their definitions on the board.
 - There are two kinds of natural resources. The kind that can be replacing in a short time is called renewable natural resources. Air, wood, cotton, food, water, land and wildlife are renewable natural resources.
 - The kinds that can be replaced at a slow rate or not at all are called a nonrenewable natural resource. Minerals and fossil fuels taken out of the earth are nonrenewable natural resources.
2. Discuss examples of fossil fuel: coal, oil, and gas. It takes millions of years for them to be replaced. Have students brainstorm resources and list them on the board in the correct category. Discuss why each one is placed in that category.
3. Lead students to draw conclusions as to the problems associated with renewable and nonrenewable resources. One solution is wise use of resources. This is called conservation. Another is to recycle materials.

Active participation:

1. Give students magazines and newspapers. Instruct them to find pictures of resources, cut them out and place on poster board in the correct category.
2. Show pictures of resources have students use response cards to identify the category:
R=renewable, NR=nonrenewable.
3. Walk around your school pointing uses of renewable and nonrenewable natural resources.

OLYMPIA Program Pre-visit Activities

The block everyone lives in is a watershed: Here's an opportunity to map yours.

1. Chose a block in your neighborhood. (Home, school)
2. List who occupies the block. (Humans, plants, animals)
3. List what the occupants (#2) need to survive.
 - Does the block provide what is needed?
 - Are any of the needs in conflict?
4. What are the environmental impacts from how humans live on the block?
5. Map the block.
 - Develop symbols to represent the occupants, and their needs.
 - Show the direction runoff would take. (Sewers, streams, etc.)

Post-Visit Lessons

After students participate in River Adventure on the Delaware, use these lesson ideas to further discussion back in the classroom.

SUSTAINABILITY

These three basic questions are meant to provide a framework to focus the class dialogue and viewpoints connection students understanding of world values, hopes expectations of the future.

1. Sustainability of _____(what?) Possible answers, fossil fuel consumption, open space, modern technology, natural habitats, educational freedom, standard of living, and American way of life, the ecosystem.
2. Sustainability for _____(whom?) I believe we should sustain (answer from question one) for _____. Possible answers: all people, some, our neighbors, friends, non-humans, some species, future generations.
3. Sustainability for how long? I believe we should sustain (above answers) for _____.
Possible answers: months, years, and forever, during the course of this class.

Follow up: How do we connect hopes and dreams to everyday actions?

Class Project: Cradle to grave resource use is common phrase for sustainability. What is the total resource use to produce and dispose of the product? What is the pollution impact on our planet to create and dispose of the product? What is the human impact on our planet it wants, produce and dispose of the product? What resources were used to dispose of the product? (Even if you recycle a product, many resources are used in the recycling process.)

1. Divide class in to teams.
2. Have each team chose a common product. One it would use daily.

Have each team record the resources used to carry their product through the design stage, manufacturing stage, transportation stage, consumer stage, estimate its useful life and estimate cost of its disposal.

GLOSSARY

Ecosystem: A community of living organisms and their interrelated physical and chemical environment.

Environment: The total of the surroundings (air, water, soil, vegetation, people, wildlife) influencing each living being's existence, including physical, biological and all other factors; the surroundings of a plant or animal, including other plants or animals, climate and location.

Nonpoint source Pollution: Contamination that originates from many locations that all discharge into a location (e.g., a lake, stream, river, land area)

Nonrenewable resources: Substances (e.g., oil, gas, coal, copper, gold) that, once used, cannot be replaced in this geological age.

Point source pollution: Pollutants discharged from a single identifiable location (e.g., pipes, ditches, channels, sewers, tunnels, containers of various types.)

Renewable resources: A naturally occurring raw material or form of energy that will be replenished through natural ecological cycles or sound management practices (e.g. the sun, wind, water, trees).

Sustainability: The ability to keep in existence or maintain. A sustainable ecosystem is one that can be maintained.

Waste Stream: The flow of (waste) materials from generation, collection and separation to disposal.

Watershed: The land area from which surface runoff drains into a stream, channel, lake, reservoir, river or other body of water: also called a drainage basin.

Wetlands: Lands where water saturation is the dominant factor determining the nature of the soil development and the plant and animal communities (e.g., estuaries, marshes)

Map of the Delaware Estuary

